Positive Bias Multithrow Switches with Integrated TTL Decoders, DC to 3.5 GHz

Featured on the cover of the Microwave Journal (September 1999), Hittite Microwave introduces the first series of positive bias non-reflective SP4T, 6T, and 8T switches.

These new multi-throw GaAs switch products will help wired & wireless infrastructure designers improve system size, performance, reliability and production margins. Wideband operation from DC to 3.5 GHz is featured, covering all cellular/PCS, wideband CDMA, wireless local loop, ISM, and CATV/DBS bands.

High isolation (30 to 50 dB) and low insertion loss (0.5 to 1.5 dB) are guaranteed over the temperature range of -40° to +85°C. Other specifications include a single positive bias (Vdd = +5V) and true TTL/CMOS compatibility in the smallest available industry standard plastic surface-mount packages. Products are available as SP4T in a 16-lead QSOP package (HMC241Q516), SP6T in a 24-lead QSOP package (HMC252Q524), and SP8T in a 24-lead QSOP package (HMC253Q524).

The switches incorporate on-chip logic decoder drivers that reduce bill of materials cost, PCB area, and design time. A 2:4 decoder is

NEW Facility Accommodates a GROWING Hittite!

Hittite is growing! Hittite Microwave Corporation recently relocated operations to a larger facility in Chelmsford, MA. The new facility provides added cleanroom, manufacturing and design space with room for future expansion.

The new 34,000-sq. ft. [3128 sq. meter] facility includes two class 100,000 clean rooms and a class 100 area for S-level die inspection and test. An environmental test lab provides full die, packaged die, microwave module screening and qualification testing.

Auto test-handlers provide 100% RF/Microwave testing for MSOP, SOIC, QSOP, SOT plastic and ceramic industry standard packages, with a total capacity to test exceeding 250,000 units per day.

Our engineers design and maintain custom software/

12 Elizabeth Drive, Chelmsford, MA 01824 Phone: (978) 250-3343 Fax: (978) 250-3373

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HMC241QS16
GaAs MMIC SP4T SWITCH NON-REFLECTIVE DC TO 3.5 GHz

**General Description**
The HMC241QS16 is a low-cost non-reflective SP4T switch in a 16-lead QSOP package featuring wideband operation from DC to 3.5 GHz, covering all cellular/PCS (450 to 2000 MHz), wideband CDMA (2000-2300 MHz), wireless local loop (3500 MHz), industrial, scientific, and medical (900 and 2400 MHz), and CATV/DBS (50 to 2150 MHz) bands. The switch offers a single positive bias and true TTL/CMOS compatibility. A 2:4 decoder is integrated on the switch requiring only 2 control lines and a positive bias to select each path, replacing 8 control lines normally required by GaAs SP4T switches or multiple SPDT switches. A +44 dBm input IP3 helps maintain the best possible dynamic range in receive applications.

**Features**
- **LOW INSERTION LOSS (2 GHz):** 0.5 dB
- **SINGLE POSITIVE SUPPLY:** Vdd = +5V
- **INTEGRATED 2:4 TTL DECODER**
- **16 LEAD QSOP PACKAGE**
  - 0.046 in² (29.4 mm²)

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HMC252QS24
GaAs MMIC SP6T SWITCH NON-REFLECTIVE DC TO 3.0 GHz

**General Description**
The HMC252QS24 is a low-cost non-reflective SP6T switch in a 24-lead QSOP package featuring wideband operation from DC to 3.0 GHz, covering all cellular/PCS (450 to 2000 MHz), wideband CDMA (2000-2300 MHz), industrial, scientific, and medical (900 and 2400 MHz), and CATV/DBS (50 to 2150 MHz) bands. The switch offers a single positive bias and true TTL/CMOS compatibility. A 3:6 decoder is integrated on the switch requiring only 3 control lines and a positive bias to select each path. The input IP3 is excellent at +46 dBm. The HMC252QS24 SP6T replaces multiple configurations of SP4T and SPDT MMIC switches and logic drivers.

**Features**
- **LOW INSERTION LOSS (2 GHz):** 0.9 dB
- **SINGLE POSITIVE SUPPLY:** Vdd = +5V
- **INTEGRATED 3:6 TTL DECODER**
- **24 LEAD QSOP PACKAGE**
  - 0.080 in² (33.5 mm²)

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HMC253QS24
GaAs MMIC SP8T SWITCH NON-REFLECTIVE DC TO 2.5 GHz

**General Description**
The HMC253QS24 is a low-cost non-reflective SP8T switch in a 24-lead QSOP package featuring wideband operation from DC to 2.5 GHz, covering all cellular/PCS (450 to 2000 MHz), wideband CDMA (2000-2300 MHz), industrial, scientific, and medical (900 and 2400 MHz), and CATV/DBS (50 to 2150 MHz) bands. The switch offers a single positive bias and true TTL/CMOS compatibility. A 3:8 decoder is integrated on the switch requiring only 3 control lines and a positive bias to select each path. The input IP3 is excellent at +43 dBm. The HMC253QS24 SP8T will replace multiple configurations of SP4T and SPDT MMIC switches.
CONTROL PRODUCTS, DC - 8 GHz

HMC284MS8G
GaAs NON-REFLECTIVE MMIC SPDT SWITCH DC - 3.5 GHz

General Description
The HMC284MS8G is a low-cost non-reflective SPDT switch in an 8-lead grounded base MSOP package for use in applications which require high isolation between two RF paths. The device can control signals from DC to 3.5 GHz and is especially suited for PDC, DCS, PCS, 2.4 GHz ISM, and 3.5 GHz frequency bands. The design has been optimized to provide extremely high isolation with minimal insertion loss in medium and low power applications. On chip circuitry allows positive voltage control operation at very low DC currents with control inputs compatible with CMOS and most TTL logic families. RF 1 or RF2 is terminated in 50 ohms when “OFF”. Applications include local oscillator multiplexing in cellular/PCS/WLL base station applications which require high isolation.

Features
ULTRA SMALL PACKAGE:
MSOP8G, 0.023 in²
EXCELLENT ISOLATION:
>45 dB
POSITIVE CONTROL:
0/+5V
NON-REFLECTIVE DESIGN

HMC189MS8
GaAs MMIC SMT FREQUENCY DOUBLER
2.0 - 4.0 GHz INPUT

General Description
The HMC189MS8 is a miniature passive frequency doubler in a low cost plastic 8-lead MSOP package. The suppression of the undesired fundamental and higher order harmonics is typically 45 to 50 dB with respect to input signal levels. The doubler utilizes the same diode/balun structures found in Hittite MMIC mixers. The doubler is ideal for high volume applications where frequency doubling of a lower frequency is more economical than directly generating a higher frequency. The passive Schottky diode doubler technology contributes no measurable additive phase noise onto the multiplied signal. The HMC189MS8 is ideal for 5.2 UNII, 5.8 ISM, microwave radio & VSAT applications.

Features
CONVERSION LOSS:
13 dB
Fo, 3Fo, 4Fo ISOLATION:
40 to 45 dB
INPUT DRIVE LEVEL:
+10 to +15 dBm

HMC226
GaAS MMIC SOT26 +3V T/R SWITCH
DC - 2.0 GHz

General Description
The HMC226 is a low-cost transmit/receive switch in an 8-lead SOT26 package for use in applications which require very low distortion at high signal power levels. The device can control signals from DC to 2.0 GHz and is especially suited for 900 MHz & 1.9-2.0 GHz applications with less than 1dB loss. The design provides exceptional P1dB and intermodulation performance; a +38 dBm 1 dB compression point and +62 dBm third order intercept at +5 volt bias. RF1 or RF2 is a reflective short when “OFF”. On-chip circuitry allows single positive supply operation at very low DC current with control inputs compatible with CMOS and most TTL logic families. Applications include 900 MHz ISM & Cellular and CDMA/TDMA PCS devices.

Features
LOW INSERTION LOSS:
0.6 dB
HIGH INPUT P1dB:
+35 dBm @ +3V
HIGH INPUT IP3:
+62 dBm @ +5V
POSITIVE CONTROL:
0/+3V to 0/+8V

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HMC285
GaAs MMIC SMT SINGLE BALANCED MIXER 1.7 - 3.5 GHz

General Description
The HMC285 is an ultra miniature single balanced mixer in an 8 lead plastic surface mount SOT26 package. This passive MMIC mixer is constructed of GaAs Schottky diodes and a novel planar transformer balun on the chip. The RF port is balanced via the MMIC balun while the LO port is connected directly to the diodes. The device can be used as an up or downconverter for PCS, W-CDMA, 2.4 ISM, or MMDS applications. The consistent MMIC performance will improve system operation and assure regulatory compliance. The HMC285 package is the smallest footprint available for a complete single-balanced mixer, 0.118” x 0.118” (3.0mm x 3.0mm).

Features
ULTRA SMALL SOT26 PACKAGE:
0.014 in² (9.0 mm²)
NO EXTERNAL MATCHING NEEDED
INPUT IP3:
+20 dBm
IDEAL FOR MMDS & W-CDMA

HMC236QS16G
GaAs MMIC SMT QPSK MODULATOR/DEMODULATOR 2.3 - 2.5 GHz

General Description
The HMC236QS16G QPSK Modulator is designed to phase-modulate a RF signal into quadrature phase states. Device input is at the RF port and output is at the LO port. The polarity of the bias current at the control ports (I and Q) defines the four phase states. Excellent amplitude and phase balance is provided by closely matched monolithic balun and diode circuits delivering 30 dB of carrier suppression in a 16-lead QSOP package (w/grounded base). The device also functions as an I/Q demodulator with data emerging from the I and Q ports when a QPSK modulated signal at the RF port is compared to a reference signal at the LO port.

Features
EXCELLENT AMPLITUDE AND PHASE BALANCE: ±0.5 dB/±1 deg.
DIRECT MODULATION IN THE 2.4 GHz ISM BAND
33 dB CARRIER SUPPRESSION
USE AS A MODULATOR OR DEMODULATOR

HMC222C12
GaAs MMIC SP4T NON-REFLECTIVE SWITCH DC - 6 GHz, SMT

General Description
The HMC222C12 is a positive bias non-reflective SP4T switch in ceramic surface mount package. This broadband industry-first multi-switch switch covers RF telecom/datacom bands from DC - 6 GHz. The switch offers a single positive bias and true TTL/CMOS compatibility. A 2:4 decoder is integrated on the switch requiring only 2 control lines and a +5V bias to select each path. A +40 dBm input IP3 helps maintain the best possible dynamic range in receiver & test instrument applications. The HMC222C12 with the integrated 2:4 TTL/CMOS decoder replaces the many control lines required by multiple configurations of SPDT switches when building a SP4T function.

Features
BROADBAND:
DC - 6 GHz
HIGH ISOLATION/LOW LOSS:
30 to 50 dB/2dB
INTEGRATED 2:4 TTL DECODER
Single Chip Solution!
SINGLE POSITIVE SUPPLY:
Vdd = +5V

Conversion Gain and Isolation
@LO = +10dBm

Phase Balance

Insertion Loss and Isolation
COMPACT CHIP WIRELESS PRODUCTS

HMC141/142
GaAs MMIC DOUBLE-BALANCED MIXER 6-18 GHz

General Description
The HMC141 is a miniature double-balanced mixer die which can be used as an upconverter or downconverter. The chip utilizes a standard 1µm GaAs MESFET process. The HMC142 is identical to the HMC141 except that the layout is a mirror image designed to ease integration into image-reject mixer modules. Broadband operation and excellent isolations are provided by on-chip baluns, which require no external components and no DC bias. The design is similar to the HMC143/144 mixers but without IF combiner, providing a broad DC to 6 GHz IF bandwidth. These devices are much smaller and more reliable replacements to hybrid diode mixers for VSAT and point-to-point radios.

Features
- INPUT IP3: +21 dBm
- LO/RF ISOLATION: 25 to 40 dB
- DC TO 6 GHz IF BANDWIDTH
- SMALL SIZE: 1.48 mm X 1.48 mm

HMC129
GaAs MMIC DOUBLE-BALANCED MIXER 4-8 GHz

General Description
The HMC129 is a miniature double-balanced mixer die which can be used as an upconverter or downconverter in the 4 to 8 GHz band. The chip can be integrated directly into hybrid MICs without DC bias or external baluns to provide an extremely compact mixer. It is ideally suited for telecom and EW / ECM applications where small size, no DC Bias, and consistent IC performance is required. This versatile product performs equally well as a bi-phase modulator or demodulator [HMC136]. For SMT requirements, the HMC129 is packaged as the HMC188C8 non-hermetic mixer or the HMC129GB hermetic mixer.

Features
- CONVERSION LOSS: 8 dB
- LO TO RF AND IF ISOLATION: 30 to 50 dB
- SMALL SIZE, NO DC BIAS REQUIRED 1.35 mm x 1.35 mm

HMC121
GaAs MMIC VOLTAGE VARIABLE ATTENUATOR DC-15 GHz

General Description
The HMC121 chip is an absorptive voltage variable attenuator. It features an on-chip reference attenuator for use with an external op-amp to provide simple single voltage attenuation control. The device is ideal in designs where analog control signal must control RF signal levels over a 30 dB range, such as AGC circuits and in temperature compensation of multiple gain stages. Applications include military ECM and communications as well as commercial microwave radios and VSAT. Also available in a 58 SMT hermetic package [HMC121GB, DC – 8 GHz] and in a 68 SMT non-hermetic package [HMC121CB, DC – 10 GHz].

Features
- WIDE BANDWIDTH: DC - 15 GHz
- LOW PHASE SHIFT VS. ATTENUATION
- 30 dB ATTENUATION RANGE
- SIMPLIFIED VOLTAGE CONTROL: 0 to -3 Vdc

CONVERSION LOSS

CONVERSION LOSS

Relative Attenuation

CONVERSION LOSS

Relative Attenuation

CONVERSION LOSS
Handling Guidelines for ESD Protection of GaAs MMICs

All electrical components are sensitive to some degree to Electrostatic Discharge (ESD), and GaAs MMICs are no exception. Many digital semiconductors have some level of protection circuitry designed into the input and output pins. GaAs MMIC designs rarely include built-in protection circuitry. Protection circuits will add reactive parasitics that limit high frequency performance.

Circuitry on GaAs MMICs can be damaged at or above a 250V ESD. This classifies these devices as Class 1A, meaning that stringent levels of ESD protection must be observed.

Electrostatic charges are created by the contact and separation of two objects with charge magnitude varying with materials composition. Conductive and static dissipative materials release this charge easily to a grounded surface. Insulators retain the charge for a longer period of time.

To protect static sensitive devices from ESD the parts must be completely enclosed with protective conductive packaging. This is typically a silver colored bag, black conductive tote box and/or conductive carrier tape. Tubes and pink poly bags labeled Antistatic or Dissipative provide No ESD Protection to the device, implying that they will not create an ESD hazard.

Prior to opening the protective packaging, the part must be placed on a conductive workbench to dissipate any charge that has built up on the outside of the package. Once the part is removed from its protective package, it must be handled only at a grounded workstation by an operator grounded through a conductive wrist strap.

Through training and auditing, Hittite Microwave maintains proper ESD handling and packaging throughout our facility as well as with our subcontractors. We are in full compliance to the ESD/ESD association guidelines and specifications.

For more information, please consult the ESD Association Advisory ESD-ADV-2.0-1994 or MIL-STD-1686.

See www.hittite.com/pdf/handguide.pdf for the full text of this application note.

New Facility...
(cont from pg 1)

hardware for automatic test stations, supporting high volume requirements with test capabilities to 50 GHz. Our custom approach provides flexibility, to accommodate varying test requirements, and diversity to maintain efficient production flow.

Automated wirebonding equipment improves yields and throughput, providing consistency when wirebonding microwave modules and single function products. Automated on-wafer RF testing provides high volume test of unpackaged die.

Each customer requirement is fully supported by our experienced sales/application and design engineering staff, via our MMIC design center. Our engineering staff has extensive semiconductor device to system level knowledge, enabling an understanding of the system designer’s needs. Our custom analog and mixed signal MMIC design experience includes MESFET, HBT, PHEMT, and BiCMOS IC fabrication processes. Our custom projects include microwave & millimeterwave design to 40 GHz, RF/IF processing, and digital signal processing.

Visit our web site www.hittite.com, to check out our 90+ plus product data sheets covering DC to 40 GHz. Technical information such as S-parameter data, a mixer spur chart calculator, many application notes and Hittite authored papers are included. Contact us to discuss your requirements with a sales/application engineer or to request a CD or traditional catalog “book”.

More facility details can be found at www.hittite.com/facilities.htm.

With our expanded capacity and continued dedication to customer satisfaction and support, Hittite Microwave Corporation is ready to help you with wired and wireless design solutions.

integrated on HMC241QS16, requiring only 2 control lines and a positive bias to select each path. The 2:4 decoder replaces 8 control lines normally required for GaAs SP4T switches. A 3:8 decoder is integrated on HMC252QS24, requiring only 3 control lines and a positive bias to select each path, replacing multiple configurations of SP4T and SPDT MMIC switches and logic drivers. HMC253QS24 includes an integrated 3:8 decoder on the switch, requiring only 3 control lines and a positive bias to select each path. This SP8T replaces multiple configurations of SP4T and SPDT MMIC switches.

Sample and Production quantities, including tape and reel packaging, are available from stock. Data sheets are available on our web site, www.hittite.com, or can be faxed upon request. A full color reprint of the Microwave Journal cover feature is also available. See page 7 for details.
WHAT'S NEW?

Sept 1999 CD Now Available!

Hititze’s latest CD is now available including 16 of our new products. The new Sept ’99 CD still provides the features that design engineers request most often; mechanical outlines, application notes, and electronic data sheets. 35,000 copies of the CD were distributed with the November issue of Microwave Product Digest (MPD). CD’s can be requested by faxing the request form below.

Full Color Reprints Available!

A complete six-page full color reprint of the Microwave Journal September 1999 cover feature is available. The article details the evolution of Positive Bias SPNT products. Copies of the reprinted article can be requested by faxing the request card below.

September 1999 Catalog Supplement

Sixteen of Hititze’s latest in-stock MMIC products are featured in our September 1999 Catalog Supplement, complementing the full line catalog. Amplifiers cover the frequency range of 2.5 to 40 GHz, providing low noise, medium power, and driver amplifier options. Hititze Positive Bias SPNT switches as featured on the cover of the Sept. ’99 Microwave Journal are also included, as well as SMT double-balanced mixers, sub-harmonic mixers, and a new GPSK modulator. Supplements can be requested by faxing the request form below.

DID YOU KNOW?...
Hititze has added 31 new products in 1999, Covering DC - 40 GHz!

WELCOME NEW SALES REPS

Hititze Microwave is pleased to announce;
Wai Tat Electronics Ltd. will represent Hititze Microwave in China.
ENS Engineering will represent Hititze Microwave in South Korea.

Please contact: Wai Tat Electronics Ltd.;
phone: +852-2799-7393
e-mail: wttl@asiaonline.net

ENS Engineering;
phone: +82-2-562-9819
e-mail: enskim@hunet.net

YES! I WOULD LIKE TO RECEIVE THE FOLLOWING:

- Future issues of OFF-THE-SHELF
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- September 1999 Catalog Supplement
- Reprint of Microwave Journal cover feature
- Full Line 1999 Catalog
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Company Name ________________________________
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Product Interest:

- MIXERS
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- AMPLIFIERS
- FREQUENCY MULTIPLIERS/DIVIDERS
- MODULATORS
- ATTENUATORS
- CUSTOM ICs

Please fax this form to: HMC Sales Department, 978-250-3373
About Hittite Microwave

Hittite Microwave Corporation is an innovative designer and manufacturer of Monolithic Microwave Integrated Circuits (MMICs) and MMIC assemblies for RF and microwave applications. Founded in 1985, our company's expertise in MMIC technology has enabled us to achieve the best price/performance value for each of the products we manufacture.

Hittite Microwave’s mission is to provide creative solutions for our customers:

We strive to be a leading and worldwide recognized supplier of microwave IC based products and components for both commercial, military, and space markets. Our products will be recognized both by their uncompromising high quality and by their unique functionality & performance. To achieve this goal, we shall rely on advanced design concepts, best available fabrication technology, and automated manufacturing & test methods.

Our standard MMIC product line consists of over 90 gallium arsenide [GaAs] MMIC die and packaged die products covering DC - 40 GHz. Our standard and custom products support a wide range of wireless and wired communications applications, including:

- **Voice**
  - Cellular, PCS, and Satellite Telephony

- **Data**
  - WLAN, GPS, RFI, Data Over Cable

- **Broadband/Video**
  - Microwave Telecom Link, VSAT, MMDS, LMDS, DBS, CATV

- **Sensor**
  - Military, Industrial, Commercial

- **Military**
  - C³, EW, ECM, RADAR

- **Space**
  - Switching Matrices, Up/Down Conversion, RADAR

Quality is the cornerstone of our corporate mission and our commitment to customers. We keep this commitment throughout our organization. Hittite Microwave is certified for ISO 9001, the accepted standard worldwide for quality.